

CECW-EG

DEPARTMENT OF THE ARMY  
U.S. Army Corps of Engineers  
Washington, DC 20314-1000

ETL 1110-2-306

Technical Letter  
No. 1110-2-306

29 May 87

Engineering and Design  
AUTOMATED DATA ACQUISITION, GEOTECHNICAL INSTRUMENTATION

## **Distribution Restriction Statement**

Approved for public release; distribution is unlimited.

DEPARTMENT OF THE ARMY  
U. S. Army Corps of Engineers  
DAEN-ECE-G Washington, D. C. 20314-1000

ETL 1110-2-306

Engineer Technical  
Letter No. 1110-2-306

29 May 1987

Engineering and Design  
AUTOMATED DATA ACQUISITION, GEOTECHNICAL INSTRUMENTATION

1. Purpose. This letter provides information and guidelines for planning, prioritizing and implementation of an automated data acquisition system for geotechnical instrumentation used in dam safety evaluations of civil works projects.

2. Applicability. This letter is applicable to all HQUSACE/OCE elements and field operating activities (FOA) having civil works responsibilities.

3. References.

- a. ER 1110-2-100
- b. ER 1110-2-110
- c. EM 1110-2-1908, Parts I and II
- d. EM 1110-2-2300

4. Background. The acquisition, reduction, processing and presentation of instrumentation data has proven to be an essential and effective means for an engineer to interpret the structural performance of all project features. The growing demand for more accurate and timely data evaluation has led to the widespread use of computers to process, perform historical comparisons and plot the information. Recent developments in the field of electronics have made it possible to install and operate automated systems that provide cost effective real time data collection for multiple projects. All types of hardware and software from a wide range of suppliers are becoming increasingly available, however, compatability among the systems and with the instrument sensors needs improvement. Information in this letter will outline a unified approach to system design that will build on existing experience and ensure compatability through the Corps. This is the first of a series of technical letters to be published in the next 18 months. The intent of this ETL is to provide uniformity in the approach to automation among the FOA and to establish some guidance for prioritization of real time data collection. The next ETL will transmit a report that identifies and evaluates sensors and hardware. It will also establish some general guidelines for use in selection of sensors and instruments based on dependability, reliability and interface capabilities. As automation programs are installed by the FOA, a data base will be developed to include organization, types of instrumentation, products/ equipment used and a point of contact.

29 May 87

5. Requirements of an Automated Data Acquisition System. Considerable thought must go into the design of each particular system to ensure that it produces the desired results and has dependability and reliability. While many components are available, each system should include the following requirements as a minimum:

- a. Each instrument must maintain the ability to be read manually.
- b. Each instrument should have the capability to be read electronically prior to entering the automated net.
- c. The system should use a microcomputer to act as the network monitor station to collect, process, display and produce a hard copy of the data at the project office or other designated point. This network monitor station must also be capable of performing a quality control check of instrument readings, respond to a preset threshold level, interface with existing project hardware and software applications and have the ability to be queried from the District or other remote location.
- d. A backup communication link to the District should be provided for the data transmission.
- e. The automated system does not relieve or replace the normal visual inspection schedule of the project features to include the instrumentation.

In addition to these primary requirements, consideration should also be given a backup power supply, lightning protection, maintenance, vandalism, system diagnosis and software versatility.

6. Priority of Automation. Automation of projects within a FOA should be accomplished over a several year period and be based on priority. When determining priority of projects, consideration should be given to the consequences of failure, life of the structural features, nature of the structure with respect to the foundation and external loading, past performance and remedial measures.

7. Cost-Effectiveness. A review of all costs associated with automation from other agencies and initial test programs within the Corps of Engineers indicate that this type of program is cost-effective in making timely dam safety evaluations. The cost-effectiveness increases at projects or locations where access is limited due to terrain and/or weather, and at project features that experience considerable pool and/or tailwater fluctuations.

8. Automation Plan. A rendering of a typical project automation plan is shown on Enclosure 1. This plan depicts satellite communication system with a telephone backup. A typical array for a cluster of instruments with the central Measurement and Control Unit is shown on Enclosure 2. A measurement and control unit can typically monitor between 25 and 50 instruments. This feature facilitates future expansion.

ETL 1110-2-306

29 May 87

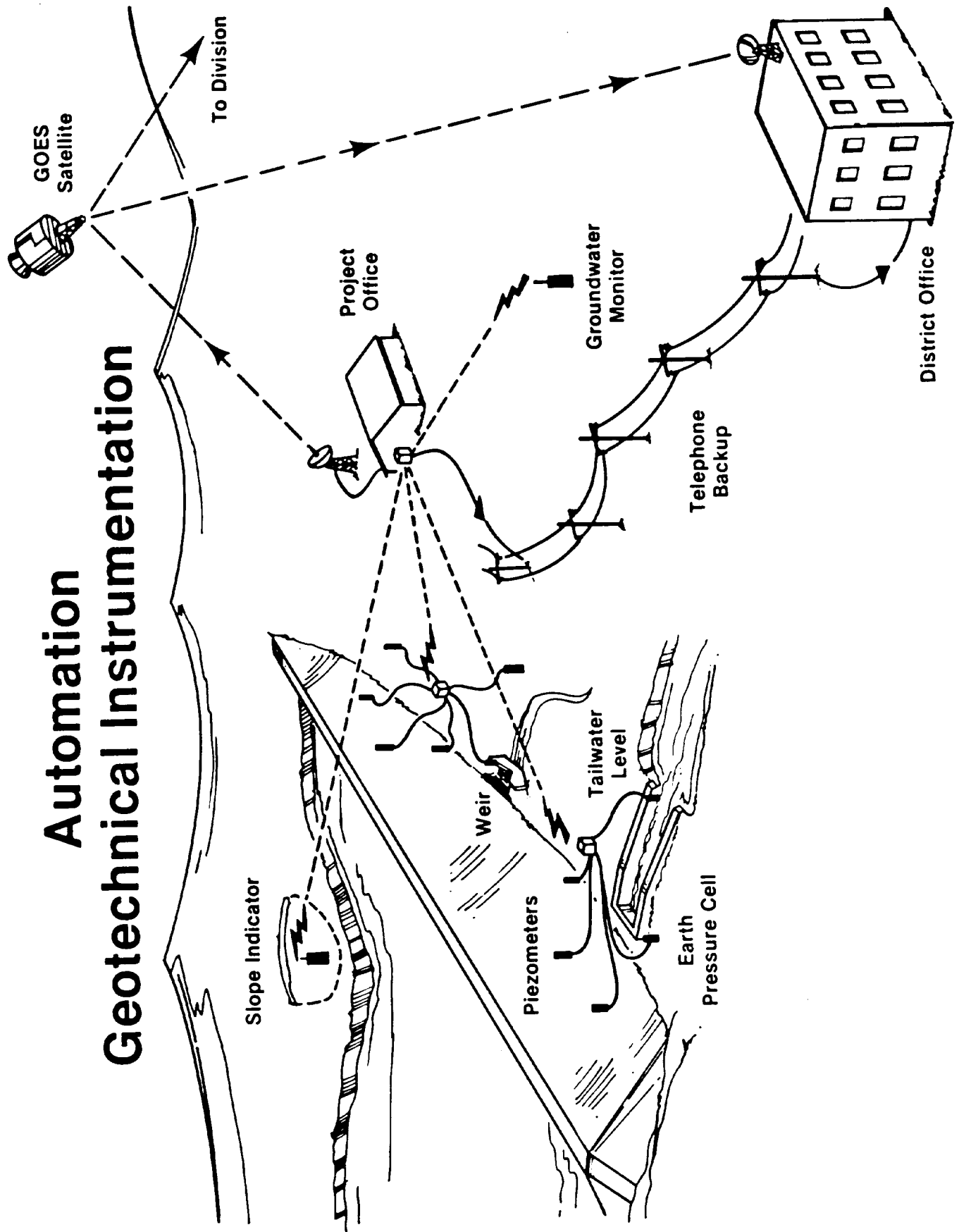
9. Research and development for this program is being conducted under the "Inland Water Resources Remote Sensing Demonstration Program" at the Cold Regions Research and Engineering Laboratory (CRREL), and under "Repair, Evaluation, Maintenance and Rehabilitation" for structural automation at the Waterways Experiment Station (WES). Points of contact are: Dr. Harlan L. McKim, CRREL-RE, (603) 646-4307, Edward F. O'Neil, WES-SC, (601) 634-3268, and Arthur H. Walz, Jr., DAEN-ECE-G (202) 272-0209.

FOR THE COMMANDER:

2 Encl



WILLIAM N. MCCORMICK, JR.  
Chief, Engineering Division  
Directorate of Engineering and  
Construction



# Typical Automation Plan

